REMARKS

This Amendment is in response to the Office Action mailed March 13, 2001. Claims 1-18 are pending and claims 20-24 have been added. Claims 1 and 7 have been cancelled and claims 6, 8 and 12 have been amended. Examination of newly added claims 20-24 is respectfully requested.

In the Office Action, claim 6 is objected to as being dependent upon a rejected base claim but would be allowable if placed in independent form. Thus, claim 6 has been amended to include limitations of prior claim 1. The amendment of claim 6 does not narrow the claim or relate to statutory requirements. Instead, the amendment is made to modify the structure of the claim as an independent claim.

Similar, claim 12 has been amended to include limitations of base claim 7. The amendment of claim 12 does not narrow the claim or relate to statutory requirements. Instead, the amendment is made to modify the structure of the claim as an independent claim.

REJECTION UNDER 35 U.S.C. § 103

The Examiner rejects claims 1, 7 and 13 as being unpatentable over Polcyn (U.S. Patent No. 5,311,588) in view of Nishiguchi (U.S. Patent No. 5,664,052). It is alleged that Polcyn suggests/teaches "determining a peak-to-mean ratio." Applicant respectfully disagrees with grounds for rejection and submits that a prima facie case of obviousness has not been satisfied. In particular, Polcyn describes peak to average ratios (PAR), which substantially differs from the peak-to-mean likelihood ratio (PMLR) as described in page 16, line 11 et seq. of the specification.

$$PMLR_k = \frac{(APMR_{max} - APMR_k)}{(APMR_{max} - APMR_{min})}$$

The contents of the numerator and denominator forming the PMLR are now claimed in newly formed independent claims 6 and 12. Claim 13 has not been amended because such amendment is unnecessary in light of the clear lack of teaching or suggestion of using the PMLR value to determine whether an audio frame being transmitted represents a voice signal.

In light of the foregoing, Applicant respectfully requests the Examiner to withdrawal the above-cited § 103 rejection and allow claims 6, 12 and 13 and those claims dependent therefrom.

The Examiner further rejects claims 2-4, 8-12 and 14-18 as being unpatentable over Polcyn and Nishiguchi in view of Graumann (U.S. Patent No. 5,737,407). Applicant contends that claims 2-4, 8-12 and 14-17 are in condition for allowance merely based on the dependency of independent claims 6 and 12. In addition, claim 18 is allowable because neither Polcyn, Nishiguchi nor Graumann, alone or in combination, suggest the implementation each claimed circuitry listed below.

(1) circuitry to determine whether a difference between the long-term averaged energy and the short-term averaged energy is less than a predetermined threshold when the short-term averaged energy is greater than the long-term averaged energy by the predetermined factor;

(2) circuitry to determine a normalized peak-to-mean likelihood ratio when the difference between the long-term averaged energy and the short-term averaged energy is less than the predetermined threshold; or

(3) circuitry to comparing the peak-to-mean likelihood ratio to a selected threshold and to determine that the audio frame represents a voice signal when the peak-to-mean likelihood ratio is greater than a selected threshold.

In light of the foregoing, Applicant respectfully requests the Examiner to withdrawal the above-cited § 103 rejection and allow claims 2-4, 8-12 and 14-18. Applicant respectfully requests the specific cite (column/line number) where such alleged teachings of the above-mentioned circuitry may be found in the cited patents if the Examiner still disagrees with Applicant after careful reconsideration.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. Cancelled.

2. (Amended) The method of claim 6 [1], wherein prior to determining the peak-to-mean likelihood ratio, the method further comprises:

determining a short-term averaged energy for the current audio frame; and

determining a long-term averaged energy for the current audio frame.

3. The method of claim 2, wherein after determining the short-term averaged energy and the long-term averaged energy, the method further comprises:

determining whether a sum of the short-term averaged energy and a factor is greater than the long-term averaged energy; and

determining that the current audio frame represents silence if the sum is less than the long-term averaged energy, without necessitating a determination of the peak-to-mean likelihood ratio.

4. The method of claim 3, upon determining that the sum is greater than the long-term averaged energy and before determining the peak-to-mean likelihood ratio, the method further comprises:

determining whether a difference between the long-term averaged energy and the short-term averaged energy is less than a predetermined threshold;

determining that the current audio frame represents voice if the difference is greater than the predetermined threshold; and

continuing by determining the peak-to-mean likelihood ratio if the difference is less than the predetermined threshold.

5. The method of claim 2, wherein the determining of the short-term averaged energy comprises:

determining an energy, in decibels, of the current audio frame;

determining a short-term averaged energy for a prior audio frame; and

conducting a weighted average of the energy of the current audio frame and the short-term averaged energy for the prior audio frame.

6. (Twice Amended) A [The] method for enhancing voice activity detection [of claim 1, wherein] comprising:

determining a peak-to-mean likelihood ratio, the determining a peak-to-mean likelihood ratio comprises

calculating an averaged peak-to-mean ratio for the current audio frame,[;]

determining a maximum averaged peak-to-mean ratio,[;]

determining a minimum averaged peak-to-mean ratio,[;]

determining a difference between the maximum averaged peak-to-mean ratio and the averaged peak-to-mean ratio for the current audio frame,[;]

determining a difference between the maximum averaged peak-to-mean ratio and the minimum averaged peak-to-mean ratio,[;] and

conducting a ratio, a denominator of the ratio being the difference between the maximum averaged peak-to-mean ratio and the minimum averaged peak-to-mean ratio, the

numerator being the difference between the maximum averaged peak-to-mean ratio and the averaged peak-to-mean ratio; and

comparing the peak-to-mean likelihood ratio to a selected threshold to determine whether a current audio frame represents a voice signal.

7. Cancelled.

8. (Amended) The communication module of claim 12 [7], wherein the voice activity detector, when executed, controls the processing unit to determine whether a sum of the short-term averaged energy and a predetermined factor is greater than the long-term averaged energy, and to signal that the current audio frame represents silence if the sum is less than the long-term averaged energy.

9. The communication module of claim 8, wherein the voice activity detector, when executed, controls the processing unit to determine whether a difference between the long-term averaged energy and the short-term averaged energy is less than a predetermined threshold, and to signal that the current audio frame represents voice if the difference is greater than the predetermined threshold.

10. The communication module of claim 9, wherein the voice activity detector, when executed, controls the processing unit to determine the peak-to-mean likelihood ratio, and to compare the peak-to-mean likelihood ratio to a selected threshold to determine whether a current audio frame represents a voice signal.

11. The communication module of claim 10, wherein the voice activity detector, when executed, controls the processing unit to determine a peak-to-mean ratio by (i) sampling an analog signal a predetermined number of times to produce a plurality of sampled signals each having a sampled value, (ii) determining a maximum value of the plurality of sampled signals, and (iii) conducting a ratio between an absolute value of the maximum value and a summation of the sampled values for the plurality of sampled signals.

12. (Amended) A [The] communication module [of claim 10, wherein]

a substrate;

a processing unit placed on the substrate; and

a memory coupled to the processing unit, the memory to contain a voice activity detector which, when executed, controls the processing unit to determine an averaged peak-to-mean ratio for the current audio frame by (i) monitoring a maximum averaged peak-to-mean ratio and a minimum averaged peak-to-mean ratio, (ii) determining a first result being a difference between the maximum averaged peak-to-mean ratio and the averaged peak-to-mean ratio for the current audio frame, (iii) determining a second result being a difference between the maximum averaged peak-to-mean ratio and the minimum averaged peak-to-mean ratio, and (iv) conducting a ratio between the first result and the second result to produce the peak-to-mean likelihood ratio.

13. (Amended) A machine readable medium having embodied thereon a computer program for processing by a machine, the computer program comprising:

a first routine for determining a normalized peak-to-mean likelihood ratio; and

a second routine for comparing the peak-to-mean likelihood ratio to a selected threshold to determine whether an audio frame being transmitted represents a voice signal.

14. The machine readable medium of claim 13, wherein the computer program further comprising:

a third routine for determining a short-term averaged energy for the audio frame, the third routine being executed before the first and second routines; and

a fourth routine for determining a long-term averaged energy for the audio frame, the fourth routine being executed before the first and second routines.

15. The machine readable medium of claim 14, wherein the computer program further comprising:

a fifth routine for determining whether a sum of the short-term averaged energy and a predetermined factor is greater than the long-term averaged energy, the fifth routine being executed before the first and second routines; and

a sixth routine for determining whether a difference between the long-term averaged energy and the short-term averaged energy is less than a predetermined threshold, the sixth routine being executed after determining that the sum is greater than the long-term averaged energy and before execution of the first and second routines.

16. The machine readable medium of claim 15, wherein the fifth routine determining that the current audio frame represents silence if the sum is less than the long-term averaged energy.

17. The machine readable medium of claim 15, wherein the sixth routine determining that the current audio frame represents voice if the difference is greater than the predetermined threshold.

18. (Amended) A voice activity detector comprising:

circuitry to determine a short-term averaged energy for an audio frame;

circuitry to determine a long-term averaged energy for the audio frame;

circuitry to determine whether the short-term averaged energy is greater than the long-term averaged energy by a predetermined factor;

circuitry to determine whether a difference between the long-term averaged energy and the short-term averaged energy is less than a predetermined threshold when the short-term averaged energy is greater than the long-term averaged energy by the predetermined factor;

circuitry to determine a normalized peak-to-mean likelihood ratio when the difference between the long-term averaged energy and the short-term averaged energy is less than the predetermined threshold; and

circuitry to comparing the peak-to-mean likelihood ratio to a selected threshold and to determine that the audio frame represents a voice signal when the peak-to-mean likelihood ratio is greater than a selected threshold.

20. (New) A method for enhancing voice activity detection comprising:

determining a peak-to-mean likelihood ratio including (i) a denominator having a value substantially equal to a difference between a maximum averaged peak-to-mean ratio

and a minimum averaged peak-to-mean ratio and (ii) a numerator having a value substantially equal to a difference between the maximum averaged peak-to-mean ratio and the averaged peak-to-mean ratio; and

comparing the peak-to-mean likelihood ratio to a selected threshold to determine whether a current audio frame represents a voice signal.

21. (New) The method of claim 20, wherein prior to determining the peak-to-mean likelihood ratio, the method further comprises:

determining a short-term averaged energy for the current audio frame; and

determining a long-term averaged energy for the current audio frame.

22. (New) The method of claim 21, wherein after determining the short-term averaged energy and the long-term averaged energy, the method further comprises:

determining whether a sum of the short-term averaged energy and a factor is greater than the long-term averaged energy; and

determining that the current audio frame represents silence if the sum is less than the long-term averaged energy, without necessitating a determination of the peak-to-mean likelihood ratio.

23. (New) The method of claim 22, upon determining that the sum is greater than the long-term averaged energy and before determining the peak-to-mean likelihood ratio, the method further comprises:

determining whether a difference between the long-term averaged energy and the short-term averaged energy is less than a predetermined threshold;

determining that the current audio frame represents voice if the difference is greater than the predetermined threshold; and

continuing by determining the peak-to-mean likelihood ratio if the difference is less than the predetermined threshold.

24. (New) The method of claim 21, wherein the determining of the short-term averaged energy comprises:

determining an energy, in decibels, of the current audio frame;

determining a short-term averaged energy for a prior audio frame; and

conducting a weighted average of the energy of the current audio frame and the short-term averaged energy for the prior audio frame.

CONCLUSION

In view of the amendments and remarks made above, it is respectfully submitted that all pending claims are in condition for allowance, and such action is respectfully solicited. It is respectfully requested that the Examiner contact the undersigned attorney in order to facilitate prosecution of the subject application.

Respectfully submitted,

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